Hematocrit

Iron is a very important mineral for the human body. It is found in every cell of the body and is required for the normal function of each cell. Brain cells need iron to make special chemicals called neurotransmitters so that they can process thoughts. Muscles need iron so that they can get energy from food. The blood needs iron so that it can carry oxygen to all parts of the body. The immune system needs iron to kill bacteria that cause illness. Taste buds on the tongue need iron so that food tastes right. Even fingernails need iron so that they can be formed correctly.

PICA: Pica is the abnormal craving for substances that are generally not considered food. Items that a person typically may crave include dirt, ice, paint chips, moth balls, hair, and others. Pica can cause serious harm to a person and needs to be corrected. Pica was named after the Magpie bird (*Pica pica*) because magpies often search for food in garbage containers.

Without adequate iron changes occur in the body that gradually alter the way the body functions. A person will often feel tired and weak. Muscles can't get enough energy or oxygen to work properly. A person may look pale because their blood does not have enough red blood cells (the part of the blood that carries oxygen) and so they don't have much color. Children without adequate iron do not grow well (in height or weight) and their brains do not develop properly. Food may start to taste "funny" and occasionally some people may even start to eat strange things like paint chips, dirt, or moth balls because of cravings not satisfied by food. The immune system may not function well so the person gets sick easily. Pregnant women low in iron are more likely to give birth to low birth weight and premature infants. Low iron can also cause complications during delivery.

Iron is of special interest to WIC because the populations served by WIC are people who are the most likely to be deficient in iron. Iron deficiency is the most common nutritional deficiency in the world, but it is most common in growing children and women, especially pregnant women. It is also more commonly seen in low income people. For this reason WIC regularly tests participants to determine if they are iron deficient.

It is impossible to tell if a person is low in iron by looking at them or by asking them how they feel. While symptoms such as feeling tired or looking pale may indicate low iron,

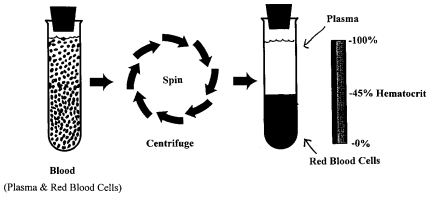
these symptoms sometimes do not occur until a person's iron level is very low. Many factors affect how and when symptoms of iron deficiency appear. Some people show symptoms of iron deficiency more easily than others.

The only way to be sure if a person has adequate iron is to do some type of blood test. Most Colorado WIC clinics determine iron level by performing a blood test called a hematocrit. A few clinics perform a different blood test that measures hemoglobin. Both tests are indicators of how much iron a person has in their body.

Hematocrits

Hematocrit: After spinning blood in a centrifuge, the hematocrit is the percentage of the blood that is made up of red blood cells.

The easiest way to determine if a person has enough iron is to measure the amount of red blood cells they have in their blood. The value from this test is called a hematocrit. Because red blood cells contain large amounts of iron, the more red blood cells a person has the more iron they generally have in their body.



Blood is made of two major parts. One part is the red blood cells. The other part is called plasma. Plasma is a clear fluid that makes blood a liquid. Red blood cells float around in the plasma and make blood look red. If you fill a tube with blood and spin it at very high speeds the red blood cells will separate from the plasma and fall to the bottom of the tube. The tube would then be filled with a clear fluid at the top and a bunch of red blood cells on the bottom. You can then measure the amount of red blood cells in the tube. If the tube is half-full of red blood cells and half full of plasma we would say that 50% (half) of the blood is red blood cells. Fifty percent would then be the hematocrit. If the tube was only one-third (33%) full of red blood cells and two-thirds (66%) full of plasma the hematocrit would be 33%. A hematocrit simply tells you what percentage of the blood is red blood cells. The more red blood cells you have the more iron you have in the blood. The more iron in the blood the more iron in the body. In general, normal hematocrit values are around 34-47%. Certain factors affect normal hematocrit values. These will be discussed soon.

Hemoglobin: Protein inside red blood cells that contains iron and carries oxygen through the blood.

Hemoglobin

A few WIC clinics measure the amount of iron in a person's blood by measuring hemoglobin values instead of hematocrits. The principle is very much the same as with a hematocrit. Hemoglobin is a protein in red blood cells. Hemoglobin is what makes red blood cells look red and is where most of the iron is located in the red blood cell. So the more hemoglobin there is in blood, the more iron in the body. When measuring hemoglobin the red blood cells are not separated from the plasma. Instead, a special instrument can measure the amount of hemoglobin by determining how red the blood appears to the instrument.

Variations In Normal Hematocrit and Hemoglobin Values

Normal hematocrit and hemoglobin values vary according to age and sex, whether a person is pregnant, whether a person smokes, and by the altitude where a person lives. Infants tend to have lower values than older children. Women tend to have lower values than men. Pregnant women have lower values than women who are not pregnant and normal values vary according to the trimester of the woman's pregnancy. People who smoke or live at high altitudes tend to have higher values than people who do not smoke or who live at lower altitudes. Tables in Appendix A at the back of this module show values for hematocrits and hemoglobins that are below normal and are considered low. The values listed in the tables give the cut-off values when the person does not have enough iron.

When looking at the tables notice that one set of tables give hematocrit values while the other set gives hemoglobin values. Within each set are two other tables. One table gives the value at which iron is considered low and the other gives the values at which iron is considered extremely low. Notice that on each table you need to know the elevation of your clinic, the age of the participant, whether the woman is pregnant and which trimester she is in, and finally, whether the woman smokes.

Smoking and Altitude

Smoking and altitude cause "normal" hematocrit and hemoglobin values to be higher than usual. This should not be taken to mean that smoking or living at high altitude gives you more iron or makes you healthier. Smoking is a significant health risk for a pregnant woman, her unborn child, and her other children.

Smoking and living at high altitude make it difficult for the blood to absorb and carry adequate oxygen to the various parts of the body. The body tries to compensate for this difficulty by making extra blood cells. This increases the body's requirement for iron and makes hematocrit values higher than normal. As an example, if a woman lived at sea level and had a hematocrit of 38%, her hematocrit would be considered normal. If she then moved to a city at 9000 feet above sea level her blood would have difficulty carrying enough oxygen and would try to make more red blood cells to raise her hematocrit above 41% to compensate. If her hematocrit stayed at 38% she would have difficulty exercising or carrying out normal daily activities. Her body would need more iron so that she could make more blood cells to carry adequate oxygen to body tissues such as muscle and brain.

Anemia

When a person does not get enough iron they stop making hemoglobin. Without hemoglobin the body stops making red blood cells. As a result the hematocrit drops and at some point the hematocrit gets low enough that the person is said to be anemic. People who are anemic usually have a variety of symptoms, the most common one is that they feel tired. They often look pale, have trouble concentrating, feel cold, and can have some changes in their skin, tongue, and appetite. If anemia gets severe a person will feel very poorly and the anemia can even become life threatening. It is important to note that different people react to anemia differently. As was stated earlier, just because a participant says that she feels fine does not mean that she is not anemic. Some people become anemic with few symptoms, at least until the anemia becomes very severe.

NRF #45 Anemia
Low risk condition

NRF #46 Severe Anemia
High risk condition

The tables in Appendix A at the back of this module show the hematocrit and hemoglobin values used by WIC to assign the nutrition risk factors for anemia: NRF# 45 Anemia and NRF# 46 Severe Anemia. NRF# 45 Anemia is a low risk condition that is followed by the WIC educator. NRF# 46 Severe Anemia is a high risk condition and the participant must be referred to the WIC nutritionist or nurse. Pregnant women who have severe anemia should be referred to the dietitian/nurse immediately.

It is important for WIC staff to remember that they are not actually diagnosing anemia. A diagnosis for anemia can only be made by a physician or other health care professional such as a physician assistant or nurse practitioner. The hematocrit performed in the WIC clinic gives us the information to determine that the participant is likely to be low in iron, to assign the applicable nutrition risk factor, to guide education, and to help make appropriate referrals.

Hematocrit Procedure

In order to assure accurate results, a standard procedure must be used each time a hematocrit is performed.

Equipment

The following equipment is required to obtain a hematocrit:

- -gloves
- -lancet
- -capillary tube
- -cotton balls
- -rubbing alcohol
- -clay tube sealer
- -centrifuge
- -hematocrit reading chart
- -band-aids (as needed)
- -sharps container

Technique

1. Put on a pair of clean gloves. Then organize all of the equipment that you will need to obtain a hematocrit (such as the lancet, capillary tube, band-aid).

Collecting Blood from Infants & Children: For infants blood is generally taken from the big toe or from the heel. For children blood is usually obtained from a finger. Blood flow is improved if the infant's or child's foot/hand is massaged before a stick is made to draw blood. It is also helpful to keep the child's foot or hand below the heart. Warming the hand or foot, especially during winter months, helps the hand or foot to bleed more freely. A calm infant or child will bleed more easily than an angry or agitated one (of course sticking a child to draw blood and keeping a child calm are often incompatible!).

2. Clean the participant's finger (adult or older child) or toe (infant) with alcohol. Use a clean cotton ball to which alcohol has been added or other similar alcohol swab. Ask the participant which finger they prefer to have pricked. It may be helpful to ask the participant to swing their hand in a downward motion below the heart or have them run their hand under warm water to help with the flow of blood. Try to get the participant to relax as this also helps blood flow to the finger tips.

   Caution: ALWAYS use a clean cotton or other swab. If the swab falls on the floor, throw it away. Do not set the swab on a dirty surface. NEVER reuse a cotton or other swab between participants. Use the swab once and then throw it away.

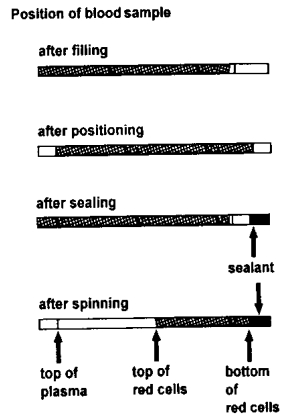
   Caution: Do not perform a hematocrit test on a participant who has a dirty hand or foot until the hand or foot has been cleaned. Hematocrits should not be obtained from the toe of a child who is brought to the clinic barefoot, without shoes, and who will be running around on the floor or ground after blood has been obtained.

Lancet: Device used to pierce the skin to draw blood. Lancets come in single use, disposable types and reusable types that require a clean stage and blade with each use.
Blade: Part of the lancet that pierces the skin. The blades on multiple use lancets must always be changed between participants. Disposable lancets must only be used once and then be discarded.
Stage: An outside part of a reusable lancet that touches the participant's skin. The blade of the lancet generally passes through a hole in the stage. The stage of a lancet should be replaced or cleaned after use with each participant.

3. Use a lancet to pierce the participant's finger or toe. Rather than lancet the tip of the finger it may be easier to lancet the side of a person's finger tip. There are fewer calluses on the side of the finger plus the participant won't be reminded of you all day as they touch objects with the end of their finger.

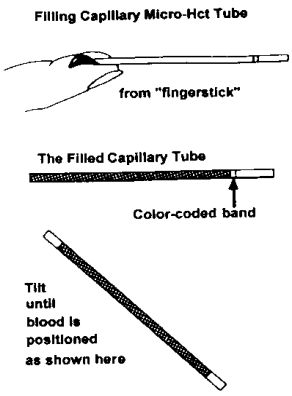
   Hold the participant's hand or foot firmly when using the lancet. Be prepared for a sudden jerk by the participant as they are jabbed.

   Some agencies use lancets that are discarded after each use. These lancets should only be used once and then be discarded. They should be disposed of in a sharps container to prevent accidental punctures. Agencies that use a spring-loaded lancet device MUST ALWAYS change the blade AND the stage between each participant.



Caution: ALWAYS use a clean lancet for each participant. **NEVER reuse a lancet from one participant to another–this includes between a mother and her own infant.** If in doubt throw the lancet away and use a new one. It is very important to not contaminate one participant with the blood from another participant.

4. Use a dry, clean cotton ball or swab to wipe away the first two drops of blood that appear after lancing the finger. Do not use the original cotton ball or swab that was used to clean the finger with alcohol (alcohol stings on a cut!). Staff may be tempted to use the first two drops of blood to ensure that they get enough blood before the finger stops bleeding, however, wiping away the blood actually helps the finger to bleed more freely.



5. Insert the end of a capillary tube (the end without a red line) into the drop of blood that is forming on the finger. Allow the blood to fill the tube up to the red line on the opposite end of the tube. It may help to hold the tube tilted downward toward the floor to allow the tube to fill more easily. As the tube fills change the angle upwards to slow the blood flow into the tube (so that the tube is not overfilled). Ideally no air bubbles should be present in the tube. Air bubbles generally indicate that an inadequate drop of blood was used to fill a tube or that the tube was not placed directly into the middle of the blood drop.

   Do not squeeze the finger to increase blood flow. This can dilute the blood with other body fluids present in the finger and result in an inaccurately low hematocrit value. If the puncture is deep enough there should be adequate blood to fill one capillary tube.

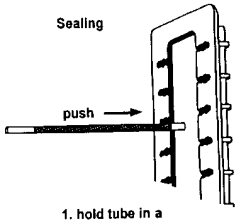
6. When the tube is filled with blood up to the calibration mark (red line), remove the tube from the drop of blood. Keep the tube level so that the blood will not flow out. If the tube is filled beyond the calibration mark gently dab a clean tissue on the end of the tube without the calibration mark and draw off a small amount of blood.

7. Tilt the capillary tube gently to center the blood in the middle of the tube. Make sure that no blood is lost.

8. Seal the end of the capillary tube (the end **with** the red calibration line) by sticking it into clay sealant. Twist the tube as it is removed from the sealant. The clay plug should be no more than 1/8 inch long. Dry the tube with a lint-free tissue after plugging to remove any blood from the outside of the tube.

   Note: It is best not to touch the clay sealant with bare hands. Oil from the hands will soften the clay. This may cause the sealant plug to fall out of the capillary tube during centrifuging.

   The capillary tube is now ready to be centrifuged.

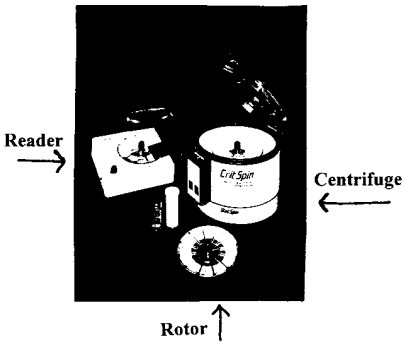


1. hold tube in a horizontal position

2. hold sealant in a vertical position

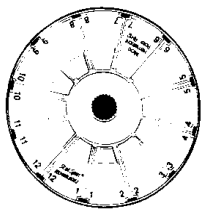
3. push tube until bottomed - twist and remove

Operating Instructions and Procedures for Centrifuge (This set of instructions was written for the typical WIC centrifuge. Staff should read the operator's manual for their centrifuge to make sure their particular centrifuge uses the same procedures.)



1. Open the centrifuge cover. Remove the cover from the rotor of the centrifuge. Put capillary tubes into the grooves provided in the rotor. Write down the number of the groove for each participant when placing tubes in the centrifuge rotor. You may be tempted to say you will remember which tubes are in which grooves, but after spinning you may not. If in doubt as to the identity of each sample you will need to obtain more samples. To save confusion, misidentification of results, and pain for the participant, write down the groove number for each capillary tube and the corresponding participant's name.

   Tubes should be placed in the centrifuge with the plugged end near the outside of the centrifuge. If you place the open ends near the outside the blood will be spun out of the tubes. Unless your centrifuge specifies otherwise, you must always balance the capillary tubes in the rotor.



Hematocrit Rotor:
Blood filled tubes fit into the numbered slots.

That is, tubes should always be placed across from each other in the rotor. If there is an odd number of tubes an empty tube should be placed across from the single tube.

2. Screw the top onto the rotor. Make sure the rotor is firmly attached inside the centrifuge. Close the lid of the centrifuge and make sure that it locks.

3. Push the "Start" button on the centrifuge. The rotor in the centrifuge should start spinning. It will spin for a preset amount of time and then stop. Most centrifuges will beep when they are finished spinning.

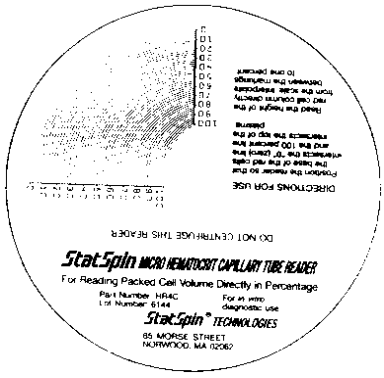
4. After the rotor has stopped spinning, open the lid of the centrifuge and remove the tubes.

   Caution: Do not open the lid of the centrifuge while the rotor is still spinning. Most models have a lock that prevents the centrifuge from being opened while spinning.

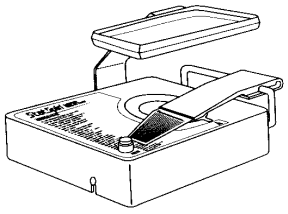
<u>Reading the Capillary Tubes</u> - There are two common ways to read the capillary tubes:

A. Using a hematocrit reading card:

   On a flat table, lay the capillary tube on a hematocrit reading card. The top of the clay plug must be aligned with the "0" percent line and the tube must be perpendicular to this line. The tube is then moved side to side along the bottom line until the top of the clear fluid (plasma) intersects the "100 percent line." Once the tube is positioned so that the top of the clay is on the "0" line and the top of the plasma is on the "100" line (and the tube should be perpendicular to the "0" line), read the line that passes through where the plasma and the red blood cells come together (i.e., the top of the red blood cells). This line gives the value for the hematocrit.



Top of plasma: align with 100 line on reader
Bottom of red blood cells: align with 0 line on reader
Line that runs through the top of the red cells is the hematocrit reading



Stat-Spin Reader

B. Using a Stat-Spin Reader:

When the rotor has stopped spinning inside the centrifuge, remove the rotor and place it on the Stat-Spin Reader. Flip the measuring scale over top of the rotor. Turn the rotor until the tube to be read is vertically positioned over the arrow. Hold down the lamp button to back light the tube. Adjust the scale until the "0" line is directly on top of the clay plug and the "100" line is directly on top of the plasma. The line that passes directly above the top of the red blood cells is the hematocrit reading. Note: You must be looking directly down on the reader to get an accurate reading.

Record the hematocrit results immediately on a piece of paper until the results can be entered into the ASPENS system. It is easy to forget the results if you do not write them down. Be sure to include the participant's name for each hematocrit if you are reading tubes for more than one person. If two tubes of blood were obtained from the same participant, the lower hematocrit reading from the two tubes should be considered the participant's hematocrit reading. If the two readings are far apart (more than 2 percentage points) or if the readings are unreasonably low or high it is recommended that the test be repeated to verify the values.

The hematocrit results are then entered into ASPENS on the Update Woman Visit Screen (WICPS104) for women or the Update Infant/Child Health Data Screen (WICPS105) for infants or children.

Frequency of Hematocrit Measurements

<u>Pregnant Women</u>

WIC requires that hematocrits be performed on pregnant women at their certification visits. Hematocrits must also be done at each trimester for women who are not receiving prenatal care. Adequate iron is critical during pregnancy. A woman who does not have adequate iron is more likely to

give birth to a low birth weight or premature infant. She is more likely to have complications during her pregnancy and have difficult labor. The only way a woman can know if her iron is adequate is by testing.

A pregnant woman who is found to have severe anemia should be referred to the WIC nutritionist or nurse immediately for evaluation and referral. Severe anemia can have very adverse effects on the outcome of a pregnancy.

Hematocrit Measurements for Pregnant Women

Required	▸ Certification Visit ▸ Each Trimester **IF** Not Receiving Prenatal Care

Postpartum Women

Non-breastfeeding postpartum and breastfeeding postpartum women are required to have hematocrits at their first certification after delivery. Pregnancy results in a huge loss of iron from the woman's body. Some iron is used to form the infant and to give the infant a supply of iron for the first few months of life. During delivery a woman loses blood, the placenta, and other tissues which contained large amounts of iron. This iron needs to be replaced. It is important for the woman to replace this iron to meet the needs of her own body as well as to ensure that she has adequate stores should she become pregnant in the near future. It takes a long time to completely replace the iron lost during pregnancy.

Hematocrits are not required for recertification of a breastfeeding woman after her initial 6 month certification as a breastfeeding woman.

Hematocrit Measurements for Postpartum Women

Required	▸ Breastfeeding Woman - At first certification visit after delivery. Not required at 6 month recertification after delivery. ▸ Non-Breastfeeding Woman - At certification after delivery.

Infants

Infants are born with a store of iron in their bodies that they receive from their mothers during pregnancy. An infant's iron stores usually last for 4-6 months. Because of this, hematocrits are not routinely performed to certify infants on the WIC Program except in certain circumstances as listed below:

- Infants initially certified on the WIC Program between 6 and 11 months of age must have a hematocrit performed at the time of certification.
- All infants who do not routinely receive an iron source at 9 months of age, such as iron-fortified formula, iron-fortified cereals, meats, or iron supplements must have hematocrits performed at that time or at 3 months after their initial certification if their initial certification was at 6, 7, or 8 months of age.

Hematocrit Measurements for Infants

Required	▸ Any infant who is initially certified between 6 and 11 months of age must have a hematocrit at the certification visit. ▸ Any infant who is not routinely receiving an iron source at 9 months of age, such as iron-fortified formula, iron-fortified cereals, meats, or oral iron supplements must have a hematocrit at that time or at 3 months after their initial certification if they were certified at 6, 7, or 8 months of age.

Children

Children are required to have hematocrits at their certification/recertification visit at one year of age, at certification/ recertification at around 18 months, and then once a year thereafter as long as their hematocrit is normal. If a child has a low hematocrit it should be repeated at each certification until it is normal.

Hematocrit Measurements for Children

Required	▸ Certification/Recertification Visit at one year ▸ Certification/Recertification Visit at around 18 months* ▸ One time per year at Certification/ Recertification Visits after 18 months **IF** the hematocrit is normal or every Recertification Visit after 18 months of age until the hematocrit is normal

*A child who is certified between 13-17 months must have a hematocrit at their next certification visit at 19-23 months. Around 18 months is when a significant number of children become anemic. In order to identify these anemic children it is important to have a hematocrit taken at 18 months or shortly afterwards (up until 23 months). Once this hematocrit has been done and, if it is normal, then hematocrits only need to be repeated one time per year.

Hematocrits Performed Outside of the WIC Clinic

Hematocrits may be performed by WIC staff or by other medical personnel who are qualified to perform hematocrits. A participant may bring a hematocrit value from their health care provider's office for certification as long as the value:

1. is not more than 60 days old and,
2. for women, that the hematocrit is performed during the physiological state for which she is being certified. A pregnant woman's hematocrit must have been performed while she is pregnant. A postpartum woman's hematocrit (breastfeeding or not) must have been performed after the termination of her pregnancy.

WIC staff need to have some assurance that hematocrits performed outside the WIC office are by qualified personnel and that the values presented by the WIC participant are the true values which were determined. Staff should be leery of values that are reported verbally by participants. Ideally the value should be written on paper (such as a prescription pad) that shows its source.

What if a child is uncontrollable and highly agitated so that a hematocrit cannot be performed?

A WIC participant may be certified without a hematocrit under such circumstances as long as they have another qualifying nutrition risk factor. The participant must be scheduled for a repeat hematocrit attempt within 60 days unless the participant has a personal, cultural, or religious belief that does not allow a hematocrit to be performed. When a hematocrit is refused the reasons must be documented in the participant's education record.

Repeat Hematocrits When Low Values Are Obtained

How soon should hematocrits be repeated if values are found to be low? This depends on the situation and the policy of the local WIC clinic. If the low hematocrit has been reported to the participant's primary care provider who will monitor the situation, there may not be any need for a repeat hematocrit until the participant's next recertification. If the participant has no health care provider the participant should be encouraged to obtain health care and report the low hematocrit value to the health care provider who can then follow it. Very low hematocrits that make participants high risk need to be referred to the WIC dietitian or nurse who will make the determination as to when or if follow-up hematocrits should be performed in the WIC clinic.

Low hematocrit values do not change quickly even when supplemental iron is given. If a clinic has a policy of repeating low hematocrit values, the repeat hematocrit should be performed one month or more after the low value was obtained. The timing for repeat measurements, however, depends on the circumstances and the severity of the low hematocrit.

High Hematocrits

Occasionally a person being certified will have a hematocrit that is considered "high." While there are no nutrition risk factors associated with "high" hematocrits there may still be concerns which need to be addressed. Very high hematocrits can be associated with certain kinds of blood diseases, carbon monoxide poisoning, and for pregnant women, higher risk of premature labor and delivery of a low birth weight infant. High hematocrit values should be uncommon. Whenever a high value is encountered staff may want to consider repeating the test to confirm the value. Technique should be reviewed to ensure that the test is being performed properly.

Pregnant Women

High hematocrits during pregnancy are associated with premature birth and delivery of a low birth weight infant. Women with high hematocrits should be referred to their primary health care provider with information about their hematocrit level. The primary care provider will then have to assess the hematocrit value as a part of the woman's total health and the progress of her pregnancy. A woman should not stop taking her prenatal vitamin with iron. It is thought that high hematocrits in pregnancy are often the result of inadequate plasma expansion and not because of too many red blood cells or too much iron.

In some cases a woman may have an elevated hematocrit because she is dehydrated. This could occur with severe nausea and vomiting. In such cases the woman should be instructed to increase her fluid intake and consult with her primary care provider.

There are no precise values for determining when a hematocrit is "high" for a pregnant woman. In general, values greater than 47% should be referred to a physician. At higher elevations (>7000 feet) 50% may be a more appropriate value for referral.

Children

High hematocrit values in children are also uncommon. When high values are identified they should be confirmed and the participant should be given the information to share with their primary care provider (PCP) at their next PCP visit. True high values can be indicative of a number of conditions that need to be reviewed by a physician. A child who is dehydrated due to a condition such as illnesses with vomiting and diarrhea may have a high hematocrit and should be encouraged to drink adequate fluids. Cut-off values which determine when a hematocrit is excessively high have not been determined.

#10 Practice!

The tables in the Appendix give normal values for hematocrits and hemoglobin. The tables show the minimal values that are considered normal. Look at one of the tables and notice that the ones for children indicate normal values based on age and the altitude at which the child lives. The tables for pregnant women use altitude, smoking, and trimester of pregnancy to determine the minimal normal value.

When certifying a participant on the WIC Program the ASPENS computer will risk the person for having anemia and serve anemia without WIC staff having to look up these values. If however, you perform a hematocrit or hemoglobin on a person between certification visits you need to manually look up the minimal values and determine if a person should be risked for anemia or severe anemia.

1. For the following participants give the hematocrit level that would result in them being assigned the Nutrition Risk Factor #45 for anemia and for Nutrition Risk Factor #46 for severe anemia.

   A. Pregnant woman who lives in Lakewood (elevation 5440 feet) is in her third trimester. She does not smoke.

      NRF #45_____ NRF #46_____

   B. Breastfeeding woman who lives in Durango (elevation 6512 feet) and is a non-smoker.

      NRF #45_____ NRF #46_____

   C. Postpartum woman smoker (1½ packs of cigarettes per day) who lives in Leadville (elevation 10,152 feet).

      NRF #45_____ NRF #46_____

D. Three year old child who lives in Springfield (elevation 4365 feet).

NRF #45_____ NRF #46_____

2. What is the iron-containing substance found in red blood cells that combines with oxygen to deliver oxygen to the cells of the body?

3. List three symptoms that indicate a person may have anemia:
   A.
   B.
   C.

4. A person can be sure that they are not anemic if they do not feel tired.

   A. True B. False

5. Complete the following describing when hematocrit measurements are required:

   A. Pregnant woman with prenatal care:

   _____

   B. Two year old child who with a normal hematocrit:

   _____

   C. Five day old infant who is receiving iron-fortified formula:

   _____

   D. Infant receiving iron-fortified formula who is being certified at seven months of age:

   _____

   E. Breastfeeding woman (10 days postpartum):

   _____

F. Three year old child with a low hematocrit:

_____

6. A breastfeeding woman who was certified on WIC right after delivery must have another hematocrit performed when she is recertified when her baby is 6 months old.

   A. True B. False

7. Under what condition must a hematocrit be performed on a nine month old infant who was originally certified at 5 days of age?

8. A pregnant woman comes into WIC to be certified on the WIC Program. She just found out that she is 4 weeks pregnant. She had blood work done at her physician's office 2 months ago and has brought paperwork from the physician's office showing her hematocrit. She would rather not be poked again for another hematocrit value. What two conditions determine whether the hematocrit value from the physician's office may be accepted for her WIC certification?

   A.

   B.

   Can the hematocrit from her physician's office be used for her WIC certification?

   ____Yes ____No